CLAIMS

1. A neutron detector comprising the combination of a solid state device including at least one sensing element having an electrical characteristic which changes in the presence of charged particles or electromagnetic radiation, and a neutron capture material which is associated with the solid state device and which has the property that it emits particles or radiation to which the sensing element or elements of the solid state device are responsive when free neutrons are incident upon it such that the solid state device provides an electrical output indicative of incident free neutrons.

2. A detector according to claim 1, wherein the capture material is incorporated in a capture layer overlying the sensing element or elements of the solid state device.

3. A detector according to claim 2, wherein the capture material is in contact with the sensing element or elements.

4. A detector according to any preceding claim, wherein the solid state device has a plurality of sensing elements arranged in a distributed array.

5. A detector according to claim 4, wherein the solid state device is a charge coupled device (CCD).

6. A detector according to claim 4, wherein the solid state device is an active pixel sensor (APS).

7. A device according to any of claims 1 or 4 to 6, wherein the capture material is a doping material incorporated in the sensing element or elements of the solid state device.

8. A detector according to any of claims 4 to 6, wherein the concentration of the capture material per unit length or unit area varies across the array of sensing elements to yield a sensitivity variation between different parts of the array.

9. A detector according to any preceding claim, including a radiation filter element overlying the said combination, the radiation filter comprising radiation filtering material.

10. A detector according to claim 9, wherein the filter element is constructed as a filter layer in which the amount of the radiation filtering material per unit length or unit area varies across the layer.

11. A detector according to any preceding claim, including a shield positioned over the sensing element or elements so as substantially to exclude radiation of a kind other than the said second kind.

12. A detector according to any preceding claim for detecting free neutron radiation, wherein the capture material has the property that free neutron radiation incident upon it causes it to emit charged particles and the sensing element or elements are responsive to the emitted charged particles.

13. A device according to claim 12, wherein the capture material includes boron-10.

14. A detector according to claim 13, including a capture element in the form of a layer of a boron-10 enriched borate.

15. A detector according to claim 12, wherein the capture material includes helium-3.

16. A detector according to claim 15, including a capture element in the form of a layer of a solid matrix containing bubbles of helium-3 gas.

17. A detector according to any of claims 12 to 16 which is sensitive to incident free neutrons with energies in the region of 0.025eV but substantially insensitive to incident free neutrons with energies above 0.5eV.

18. A detector according to any of claims 12 to 17, wherein the solid state device has a distributed array of sensing cells and, overlying the sensing cells and the capture material, a filter layer made of a neutron energy discriminating material selected to admit through the filter layer

only neutrons having various energies, the thickness of the layer varying across the array of sensing cells to yield an energy spectrum sensitive profile for the detector.

19. A detector according to any of claims 12 to 16, including a neutron moderator layer over the solid state device and the capture material, the moderator layer being formed of a material which reduces the energy of free neutrons passing through the layer, whereby the detector is sensitive to incident free neutrons with energies higher than 0.5eV.

20. A detector according to any preceding claim, including a discriminator coupled to an output of the solid state device, the discriminator selecting only electrical signals received from the output with an amplitude greater than a predetermined value.

21. A detector according to any preceding claim, including means for integrating an output of the solid state device over time to produce a radiation dose reading.

22. A detector according to any preceding claim, including a plurality of different capture elements including a capture material or materials, and a capture element carrier member carrying the capture elements, wherein the carrier member and the solid state device are positioned with respect to each other and moveable relative to each other such that different capture elements may be brought into juxtaposition with the sensing element or elements of the solid state device for the purpose of selecting different detector characteristics.

23. A detector according to any preceding claim, including a plurality of different filter elements and a filter carrier member carrying the filter elements, wherein the filter carrier member and the solid state device are movable relative to each other such that different filter elements may be brought into juxtaposition with the sensing element or elements of the solid device for the purpose of selecting different filter characteristics.

24. A detector according to any preceding claim, including a plurality of different shield members having different shielding characteristics which are selectively locatable to shield the capture material thereby substantially to exclude different kinds of unwanted radiation according to which shield member is selected.

25. A detector according to any of claims 1 to 11 or 20 to 24, wherein the capture material has the property that x-rays incident upon it to cause it to emit radiation to which the sensing element or elements are sensitive.

26. A detector according to claim 25, wherein the capture material has the property of emitting photons when x-rays are incident upon it.

27. A detector according to claim 26, wherein the capture material includes zinc sulphide.